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The Conservation status of *Saintpaulia teitensis* B.L.Burtt (Taita African Violet) in the forests of the Taita Hills, Kenya.

The forests of the Eastern Arc Mountains of Tanzania and Kenya (Fig 1) is recognized as a global biodiversity "hot spot", because of their high species richness, large number of endemic plant and animal species, and threat from human caused disturbances. There are approximately 800 endemic plants in the Eastern Arc forests, highlighting the importance to conserve these forests. The genus *Saintpaulia*, commonly known as the African violet, is endemic to some of these forests. However, despite the rich biological diversity, the Eastern Arc forest cover has decreased by 77%. Forest removal and forest disturbance are human-caused.

The forests of the Taita Hills in southeastern Kenya are the smallest and most fragmented ones in the Eastern Arc Mountains. The Kenyan Forest Department and the members of the community (Taita) who live around the forest jointly manage the forests. The Taita people (Fig 2) grow fruits and vegetables along the steep slopes. Individuals typically own parcels of land at different elevations, and thus different rainfall zones, to safeguard the family against crop failure. This has resulted in intense forest clearing and an extremely fragmented pattern of land ownership. Currently, the remaining indigenous forest covers only one-tenth of the area they covered in 1950. It is scattered in 12 fragments totaling approximately 740 acres, and ranging in size from less than a 2.5 acres to 490 acres (Mbololo forest).

Mbololo forest is the only place that the Taita African violet, *Saintpaulia teitensis* (Fig. 3), can be found. In 1988, an intensive botanical survey conducted by the National Museums of Kenya documented the occurrence of only one population of *S. teitensis*. The species was designated as "Vulnerable" because of its small population size. Fortunately, recent surveys by Kamau Wakanene Mbuthia and B. Bytebier (Taita Hills Biodiversity Project) found other small populations of *the S. teitensis* occurring within the same forest. Realizing the need for protection of *S. teitensis* the author's conducted a research project with three objectives: (i) intensely survey Mbololo forest to document other African violet populations (ii) establish permanent forest health monitoring plots in association with an African violet populations, and utilize existing forest plots to describe the vegetation associated with violet populations, and (iii) use Landsat satellite images to analyze forest cover changes in and around Mbololo forest over the last 20 years

Methods

Fieldwork for this study was done in June 2002. We extensively walked the forest searching for African violet populations. Using 164 feet $\times$ 98 feet sampling plots, we collected vegetation data in areas associated with African violet populations as well as other forest areas. We then established a forest health monitoring plot (four, 24 foot in radius subplots) following the procedure used by USDA Forest Service. The Forest Service analyzed forest cover changes using Landsat satellite images.

Results

We recorded eight separate populations of *S. teitensis* in Mbololo forest. However, we believe there may be a few more, hidden on the steep and inaccessible slopes. We documented a total of 74 tree species (trees > 5 inches in diameter) occurring within the sampled plots. Considering the ten most important canopy species, we determined that there was a 60% similarity in species composition between plots with African violets and the rest of the forest. At sites with African violets, the more common canopy tree species included *Newtonia buchananii*, *Strombosia scheffleri*, *Syzygium sclerophyllum*, *Craibia zimmermannii*, and *Chrysophyllum gorungosanum*. Most of these species are indicative of a forest with very little disturbance. For the rest of the forest, the more common species were *N. buchananii*, *S. scheffleri*, *Macaranga conglomerata*, *Tabernaemontana stapfiana*, and *Albizia gummifera.* Except for *S. scheffleri,* the rest are usually associated with forest disturbance. Human impact in the forest is mainly selective logging, which results in gaps in the forest that are colonized by pioneer species. Overall, tree densities in the canopy were higher in African violet plots (326 trees/acre) compared to the rest of the forest (255 trees/acre).

In the understory, tree species composition was 70% similar between plots with African violets and the rest of the forest. Common species were *Pauridiantha paucinervis*, *Garcinia volkensii*, *S.*

scheffleri, and *Psychotria* species. Densities in the understory were essentially similar in the African violet plots and the rest of the forest, with approximately 2874 trees,saplings and seedlings/acre. It is apparent that human impact is more conspicuous in the canopy tree layer than in the understory layer.

We established one forest health plot in association with one African violet population. The trees in this plot are much healthier as evidenced by lack fewer damages when compared to trees on forest health plots in more disturbed (Chawia & Ngangao) forests of the Taita Hills. Together with other plots to be established, these will provide baseline data for future measurements and forest health trend analysis. These plots will generate essential ecological information necessary for the long-term management and protection of these unique habitats.

Overall, forest cover around Mbololo forest has declined in the past decade. Satellite image analysis shows that natural vegetation (bush land in lowlands and closed canopy indigenous forest at higher elevations) declined by approximately 20% between 1988 and 2000. This loss of vegetation cover is mainly in lower elevations that are too dry and hot to support violet growth. These areas were cleared for farming. Interestingly, we observed that some of the areas once cleared for crops are now abandoned and slowly reverting back into indigenous forest. While such areas are small, it is encouraging to see that farmland can easily revert into forest if abandoned for a long time.

Discussion

Forest composition has changed dramatically in the last 30 years. Studies in the early 1970's identified *Ocotea usambarensis* (camphor) and *Podocarpus* species (East African yellowwood) as dominant species within the Taita Hills forests. Currently, very few of these important timber species remain, indicating a major human impact on forest composition. The violets seem highly specialized in terms of habitat requirement, occurring only under mist covered closed-canopy forest (Fig 4) and on near-vertical, moist rocky outcrocps (Fig 5). Considering that selective logging exposes otherwise sheltered areas to desiccation and high light intensities that are unfavorable to violet growth, there is a need for a better understanding of the environmental requirements of the African violets, and impacts of logging on the violets.

The genus *Saintpaulia* has evolved within the Eastern Arc Mountains and has not spread far from its center of creation. Most species occur highly localized and in small populations. *S. teitensis* is only known from Mbololo forest, where we have now documented eight populations. In order develop an efficient and effective species conservation management plan, there is an urgent need to establish whether these are genetically distinct populations, or one single population that occurs in a fragmented manner. In addition, detailed pollination studies are needed to ensure the long-term survival of these plants in their natural habitat.

Local communities have long understood the importance of conserving the forests and applied traditional forest management strategies well before British colonization in the late 1880's. The local people have traditionally utilized Mbololo forest as a source of construction poles, firewood, medicinal plants (both for humans and animals), and for cultural rituals such as rainmaking and burials. However, the human population has increased substantially around these forests, and thus the personal land holdings have become smaller forcing the residents to clear more of the forest to create farms. This in itself is a major long-term threat to the African violets.

While most of the African violet populations in Mbololo are currently not under any eminent threat, some of the populations close to the forest boundary are at a higher risk of destruction due to human encroachment. A clearly demarcated forest boundary is lacking in some areas, which may confuse the local people as to where the protected area starts and may lead to forest encroachment.

Currently the Taita Hills forests are under management the management of Forest Department. However, in a new forest conservation policy, the Kenyan government foresees a forest management strategy where local communities play a significant role in the management of the forests. Communities playing an active role in forest management may ensure the long-term survival and conservation of Mbololo forest. In addition, a large part of the forest is still under private land and therefore unprotected. With a large portion of the forest within private ownership, local people have a greater role to play in the conservation of the forest.

The conservation of Mbololo forest depends on development of conservation strategies that take into account environmental, economic, and social values of the Taita people living adjacent to the forest. These people are generally poor and many of them rely on the forest for domestic and subsistence use and even most importantly for domestic water sources. Because they benefit from the forest, they realize

the importance of conserving it. However, due to poverty, lack of alternative sources of revenue and other factors such as crop damage by forest-dwelling animals, forest destruction takes place to support local livelihoods. Therefore, to enhance the conservation of Mbololo forest and reduce forest damage, there is the need to improve the livelihoods of people relying on the forest. Promoting alternative sources of income, thereby reducing dependence on the forest or the need to clear it can enhance forest conservation. Promoting income-generation activities with a direct link to the forest will make communities greatly appreciate the continued existence of the forests. Local people must also play an active role in the management of the forest, which will encourage them to be more vigilant in protecting it against illegal activities such as logging. Expansion of areas under forest cover may alleviate resource extraction pressures from Mbololo forest in the long-term. Target areas for forest restoration may include individual land holdings in form of agroforestry, and in degraded areas within Mbololo forest and neighboring forest.

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Authors

Kamau Wakanene Mbuthia, National Museums of Kenya Kamau_wakanene@hotmail.com
Gerard Hertel, West Chester University ghertel@wcupa.edu

Figure 1 map showing research area in Kenya, East Africa

Figure 2 Mr Mbuthia interviewing Tiata people about the benefits they derive from Mbololo forest

Figure 3 *Saintpaulia teitensis* in Mbololo forest, Taita Hills, Kenya

Figure 4 cloud in Mbololo Forest; cloud moisture needed by the violets for their survival

Figure 5 *S. teitensis* growing on rock outcrops; Kamau Wakanene Mbuthia viewing the violets